Region 1 FY 2014 Invasive Species Control Program Proposal

Refuge/complex name: Malheur National Wildlife Refuge

Project title: Efficacy of electrofishing to reduce recruitment of common carp

Total amount requested: $52,973

Project description: Distinct project with well-defined objectives (10 points):
Reduction of common carp abundance and biomass in Malheur Lake and adjacent waters will require population control efforts targeting more than one life stage. Common carp have specific habitat requirements for spawning – they tend to aggregate in shallow or seasonally flooded areas with abundant vegetation – thus adults, eggs, and embryos are spatially and temporally clumped. However, the location of spawning sites may differ among years because of lake-level fluctuations, so any control method that targets eggs and embryos must be portable enough to track these changes.

Fish eggs and embryos can be quite sensitive to electrical fields, and there is a fairly extensive body of research that has investigated the effects of electrofishing from the standpoint of reducing mortality to species of conservation concern. Substantially less research has focused on whether the electrofishing can be used to increase mortality at early life stages and implemented as a control method for nuisance or invasive fishes, such as carp (Nutile et al. 2013; Transactions of the American Fisheries Society 142:1-9).

Our goal is to investigate the efficacy a portable electrofishing system to help control common carp killing eggs and embryos. There are few data available on the strength of electrical field needed to cause high mortality in invasive carp, but it is evident from studies of other cyprinids that the effect of electricity can depend on water chemistry, egg size, and type of electrical system used (Nutile et al. 2013). Thus, the first objective (Phase I) is to determine the optimal electrofishing setting to kill the eggs and embryos of common carp under environmental conditions similar to those expected in Malheur Lake. With these data, we can evaluate whether it is feasible to develop portable system for use in the field; development of the system will constitute a separate objective and study (Phase II).

The deliverable will be a final report on optimal electrofishing settings to kill embryos of common carp, and an assessment of whether it is feasible to proceed with development of a field application. Results will be used to help develop a system to kill embryos of common carp that will be ultimately used as part of an integrated carp population control strategy in Malheur NWR.

Potential for maximum control/Likelihood of success (10 points): The likelihood of achieving permanent or long lasting control of common carp utilizing this methodology is great in combination with other tools. Targeting different life stages is imperative for successful control of common carp. Many methods to control adult and sub-adult carp are available and well documented, such as commercial fishing and set (trammel) nets. However, a control method to deplete the early life stages (i.e., egg and embryo) of common carp has not been developed.

Submerged and emergent vegetation should increase if control methods that target adult carp are successful at reducing carp biomass. Paradoxically, those adults that do remain may thus have access to additional spawning habitats and could experience very high reproductive success. Thus, if a control method that also specifically targets spawning and juvenile recruitment is not developed, then benefits from other control efforts may be ephemeral or even futile, such as the historical treatment of rotenone on Malheur Lake. Presently, the Refuge has a carp biomass density of 500–700 lb/acre. The identified management target is 100 lb/acre in 103,799 acres of the 187,500 acre Refuge. This study has the potential to revolutionize carp control not only for the Refuge, but any other water body infested with this invasive species.

Biological benefit to priority species or BIDEH (10 points): Common carp have been a serious threat to the biological integrity of the Refuge since 1954. They have been responsible for a >75% decrease in duck production on Malheur Lake, which indicates we are not fulfilling our Congressional mandate of "providing a breeding and nesting ground for migratory water birds." Before the introduction of carp, Refuge narratives described nine species of submerged aquatic vegetation, but recent sampling suggests they are rare or absent. If electrocution of carp eggs and embryos are viable – and used in conjunction with other control methods for invasive carp – then vegetation and wetland and lake habitats should improve for resident and migratory bird species and for native fish species, including species of concern like redband trout, tui chub, and Malheur mottled sculpin.

Sustainability (10 points): With the successful completion of Phase 1 in the laboratory, the technology would be field tested at Malheur NWR. When the equipment was optimized, each spawning season the equipment would be used to decrease the number of carp in Malheur Lake. Abernathy Fish Technology and Malheur NWR are committed to creating a viable, sustainable application.

Monitoring to document and evaluate project success (10 points):
Monitoring of test results will occur at Abernathy Fish Technology Center. Adaptive management will be applied to optimize the tool to cause mortality of carp eggs and embryos.

Budget: The total budget request of ~$53,000 comprises salaries (~$42.5k) for staff at Abernathy Fish Tech Center (GS-11 project biologist, GS-11 electrical engineer, and GS-13 ecological modeler), equipment and supplies ($6.5k); and travel for site visits, fieldwork, and meetings (~$4k). Additionally, Abernathy will provide in-kind support as additional staff time for GS-13 ecological modeler (analysis & report preparation), and use of a field truck (plus maintenance), trailer, and various lab equipment. The study depends on a source of carp eggs and embryos, so the project schedule must be timed to match the spawning ecology of carp, which spawn in the late spring and early summer. Consequently, the project will span fiscal years 2014 and 2015. Work in FY2014 will involve site visits to Malheur NWR, development of the experimental design, and pilot work with carp eggs and embryos. The bulk of the project will be completed in FY2015, with construction of experimental chambers, fish capture and spawning, electrical mortality trails (timed with carp reproduction in summer 2015) and report preparation. The budget request by year is FY2014 = $9,028 and FY2015 = $43,945.